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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/531,468 | 04/15/2005 | Hongyu Yue | 267159US26PCT | 7011 |

22850 7590 12/20/2006
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| EXAMINER |
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CHEN, KIN CHAN

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| ART UNIT | PAPER NUMBER |
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1765

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS | 12/20/2006 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/531,468

Applicant(s)

YUE, HONGYU

Examiner

Kin-Chan Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 September 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8, 11-26 and 29-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 11-26 and 29-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-8, 11, 12, 22-26, and 29-31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1 and 22, Claims recite the signals comprise a first filtered endpoint signal and a second filtered end point signal, therefore, the signals should be at least **two filtered endpoint signals** rather than recited "at least one filtered endpoint signal" which may include only one filtered endpoint signal, rather than two signals (e.g., first and second filtered endpoint signals). As such, claims are vague and indefinite.

Claim 11 depending from a canceled claim 10 is vague and indefinite because the claim cannot depend on a canceled claim.

Claim 29 depending from a canceled claim 28 is vague and indefinite because the claim cannot depend on a canceled claim.

Claim Rejections - 35 USC § 103

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3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-8, 11-26, and 29-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harvey et al. (US 2004/0045934) in view of Willis (US 2004/0004708) or Nulty (US 5,045,149).

In a method for determining an endpoint of the plasma process, Harvey teaches that at least one endpoint signal may be measured. At least one filtered endpoint signal may be generated by applying a Savitsky Golay filter to the at least one endpoint signal. An endpoint of the plasma process from the at least one filtered endpoint signal may be determined. At least one filtered endpoint signal may comprise a smoothed endpoint signal and an endpoint transition. At least one filtered endpoint signal may comprise an endpoint transition. At least one endpoint signal may comprise an optical signal from the plasma processing system. The optical signal is related to a spectral irradiance of emitted light from said plasma processing system. The optical signal may be measured using an optical diagnostic subsystem. The optical diagnostic subsystem comprises at least one of a detector or an optical filter. At least one filtered endpoint signal may comprise a first filtered endpoint signal and a second filtered endpoint signal. The endpoint may be determined from a differential signal, which comprises at least one of a

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first derivative, and a second derivative of the ratio signal. See abstract, [0012]-[0014], [0105], [0128], Figs. 5-9.

Harvey does not explicitly state that two endpoint signals corresponding to two chemical constituents may be used to determine the endpoint. However, as is well known, the plasma etch removes one type of material and exposes another type material, the chemical composition of the plasma changes which gives rise to changes in the optical emission spectra (the appearance or disappearance of the characteristic emission lines). Two sets of data (such as from two chemical constituents) may be taken to determine the endpoint signal. Willis or Nulty is relied to show that it is common to take two sets of data (such as from two chemical constituents) in determining the endpoint signal for improving the endpoint detection. See abstract, [0062][0067]-[0069][0072] of Willis, or col. 1, lines 20-39 of Nulty. Hence, it would have been obvious to one with ordinary skill in the art to use two sets of data (such as from two chemical constituents) as disclosed by Willis or Nulty in the method of Harvey in order to improve the endpoint detection. Furthermore, it would have been obvious to one with ordinary skill in the art to perform data analysis and manipulation such as division (take the ratio of two signals) or multiplication of data for data enhancement, it is merely choices of engineering.

The limitations of claims 1, 2, 4, 6-8, 11,13,16-18,21,31, 32, 34,35 have been addressed above and rejected for the same reasons, *supra*.

As to system (apparatus) claims 22-26, and 29,37,38 in order to perform the methods in claims 1, 6-7, 8, 4,5,and 11 respectively, the limitations of the aforementioned system (apparatus) claims would be included.

As to dependent claim 5, Harvey teaches determining the endpoint from at least one filtered endpoint signal comprising using at least one of a start time of the endpoint transition, an end time of the endpoint transition, and an inflection time of the endpoint transition (Figs 13A, 14A, and descriptions of the Figs).

As to dependent claims 14 and 15, Harvey teaches measuring the first (or second) endpoint signal further comprising filtering the first endpoint signal, the filtering comprising at least one of a moving average, a finite impulse response filter, and a Savitsky Golay filter. See [0099][105][128].

Harvey teaches a derivative of the one end point may be determined [0024] [0098] [0108] [0111]. Hence, it would have been obvious to one with ordinary skill in the art to perform a smoothed first derivative or second derivative of the signal (claims 3 and 20) because it is simply a data manipulation and the choice of engineering depending on the requirement for obtaining the clear endpoint signal in a specific product.

As to dependent claims 12, 19, and 30, Since Savitsky Golay filter is used in the system and process, hence, it would have been obvious to one with ordinary skill in the art to include the filter window in order to better define the range tailoring to a specific product. The above cited claims differ from the prior art by specifying well-known features (such as setting a polynomial order in the Savitsky Golay smoothing

filter) to the art of data fitting and analysis, the examiner takes official notice. A person having ordinary skill in the art would have found it obvious to incorporate said Savitsky Golay smoothing technique to same in order to obtain clear endpoint signal for a specific product with a reasonable expectation of success. It is noted that applicant did not traverse the aforementioned conventionality (e.g., well-known features, common knowledge), which have been stated in the previous office action (September 5, 2006).

As to dependent claims 33, 36, 39, since the plasma etch removes one type of material and exposes another type material, the chemical composition of the plasma changes which give changes in the optical emission spectra. Therefore, it would have been obvious to one with ordinary skill in the art that the concentration of the first chemical constituent decays and that of the second one rises during the endpoint.

5. Claims 1-8, 11-26, and 29-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harvey et al. (US 2004/0045934) in view of Koshimizu (US 6,297,064).

In a method for determining an endpoint of the plasma process, Harvey teaches that at least one endpoint signal may be measured. At least one filtered endpoint signal may be generated by applying a Savitsky Golay filter to the at least one endpoint signal. An endpoint of the plasma process from the at least one filtered endpoint signal may be determined. At least one filtered endpoint signal may comprise a smoothed endpoint signal and an endpoint transition. At least one filtered endpoint signal may comprise an endpoint transition. At least one endpoint signal may comprise an optical signal from the

plasma processing system. The optical signal is related to a spectral irradiance of emitted light from said plasma processing system. The optical signal may be measured using an optical diagnostic subsystem. The optical diagnostic subsystem comprising at least one of a detector or an optical filter. At least one filtered endpoint signal may comprise a first filtered endpoint signal and a second filtered endpoint signal. The endpoint may be determined from a differential signal, which comprises at least one of a first derivative, and a second derivative of the ratio signal. See abstract, [0012]-[0014], [0105], [0128], Figs. 5-9.

Harvey does not explicitly state that two endpoint signals corresponding to two chemical constituents may be used to determine the endpoint. However, as is well known, the plasma etch removes one type of material and exposes another type material; the chemical composition of the plasma changes which gives rise to changes in the optical emission spectra (the appearance or disappearance of the characteristic emission lines). Two sets of data (such as from two chemical constituents) may be taken to determine the endpoint signal. Koshimizu is relied to show that it is common to take two sets of data (such as from two chemical constituents) and the ratios thereof in determining the endpoint signal for improving the endpoint detection. See abstract, col. 7, lines 11-17; col. 8, lines 5-14, Figures. Hence, it would have been obvious to one with ordinary skill in the art to use two sets of data (such as from two chemical constituents) and the ratios as disclosed by Koshimizu in the method of Harvey in order to improve the endpoint detection. Furthermore, it would have been obvious to one with ordinary skill in the art to perform data analysis and manipulation such as division (take the ratio

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of two signals) or multiplication of data for data enhancement, it is merely choices of engineering.

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As to dependent claims 33, 36, 39, since the plasma etch removes one type of material and exposes another type material, the chemical composition of the plasma changes which give changes in the optical emission spectra. Therefore, it would have been obvious to one with ordinary skill in the art that the concentration of the first chemical constituent decays and that of the second one rises during the endpoint.

Response to Arguments

6. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published

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applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

December 14, 2006



Kin-Chan Chen
Primary Examiner
Art Unit 1765